MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2018/19

ECE3066 ARTIFICIAL INTELLIGENCE SYSTEMS AND APPLICATIONS

(LE, EE, CE, TE, NE)

29 MAY 2019
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of 4 pages including cover page and appendices with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

Question 1

(a) Draw TWO diagrams to compare the difference between classical programming and machine learning. [4 marks]

(b) Discuss the main difference between supervised and unsupervised learning. [4 marks]

(c) Identify THREE technical forces that accelerate the development of deep learning. [3 marks]

(d) Identify THREE types of deep learning networks and discuss their operations. [6 marks]

(e) Preventive maintenance is scheduled, routine maintenance to keep equipment running as well as prevent downtime and expensive repair costs. Discuss how preventive maintenance is done traditionally and how it can be improved by leveraging on artificial intelligence. [8 marks]

Question 2

(a) Draw a flowchart to depict the general workflow in developing a machine learning system. [3 marks]

(b) Discuss THREE methods that can be used to rescale the features in the dataset. [6 marks]

(c) Explain how hold-out validation is applied for model evaluation. [6 marks]

(d) Explain what is overfitting and suggest TWO methods to prevent overfitting. [5 marks]

(e) The confusion matrix for a credit card fraud detection system is shown in Figure Q2. In this system, a positive case implies that the transaction is considered abnormal. Analyze the confusion matrix and calculate the following performance metrics for this system:

i. True positive [1 mark]

ii. Accuracy [2 marks]

iii. Precision [2 marks]

		Actual	
		Abnormal	Normal
Predicted	Abnorma	67	113
	Normal	33	387

Figure Q2

Continued...

Question 3

(a) Describe TWO types of supervised learning and explain the operations involved in each type. [4 marks]

(b) Decision tree is a hierarchy of "True or False" questions that leads to a decision.

i. Explain the process of building a decision tree classifier. [6 marks]

ii. Overfitting is a common issue in decision tree. Discuss how this issue can be prevented when building a decision tree. [4 marks]

(c) As a data engineer, you are required to analyse the Python script in Code Listing Q3 and perform the following tasks:

i. If there are 500 samples in the dataset, how many samples are used for training and testing? [4 marks]

ii. Based on Code Listing Q3, develop the Python script to build a k-nearest neighbour (kNN) model for classification using the training samples and evaluate its accuracy using the testing samples. Assume that all default values are used in building the model. [7 marks]

```
from pandas import read_csv
from sklearn.neighbors import KNeighborsClassifier
from sklearn.model_selection import train_test_split
df = read_csv("dataset.csv")
dataset = df.values
X = dataset[:,:3]
y = dataset[:,3]
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3)
```

Code Listing Q3

Continued...

Question 4

(a) As a machine learning specialist, you are required to implement a fully connected neural network for a binary classification system with three input features. There should be two hidden layers with two neurons in each hidden layer. The hidden layers use RELU activation function, while the output layer uses a sigmoid activation function.

i. Draw the neural network. [8 marks]

ii. Write the Python code to build this neural network using Keras API. [6 marks]

(b) If the input matrix is as shown in Figure Q4, determine the output of a 2 x 2 max pooling with a stride of 2 in both directions. [4 marks]

2	1	0	-1
-3	8	2	5
1	-1	3	4
0	1	1	-2

Figure Q4

(c) Write the Python code to implement a convolutional neural network (CNN) for a 5-class classification system using Keras API if the input grayscale images have the size of 64 x 64 pixels. There should be 20 filters with kernel size of 7 x 7 and zero padding in the CONV layer. Use max pooling with pool size of 2 x 2 and stride of 2 in both directions in the POOL layer. Use RELU activation function for the ACT layer and softmax activation function for the FC layer.

INPUT → CONV → ACT → POOL → FC

[7 marks]

End of Paper